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" *To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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A NEW FRENCH FORESTRY TEXT-BOOK.

Les Forêts. Par L. Boppe, Directeur honoraire de l'Ecole Nationale des Eaux et Forêts de Nancy, et Ant. Jolyet, chargé de cours à l'Ecole. Pp. xi. + 488. (Paris: J. B. Baillère et Fils, 1901).

WITHIN the last ten years the course of instruction at Nancy has been considerably modified. The school is attended by some foreign students, who, as well as a few occasional private French students, are admitted without any regular examination. Formerly, students intended for service in the State and Communal forests of France passed a preliminary competitive examination in the subjects usually taught at a Lycée, including physics and chemistry. A knowledge of botany, entomology and geology, however, was not required of them, these subjects being taught *ab initio* at Nancy; in those days the marks obtained for forestry unduly overshadowed those given for natural history, and only a few devoted naturalists were to be found among French forest officers. Forestry teaching at Nancy also was much too dogmatic, and not sufficiently based on experimental results.

At present, French forest students who are intended for the service of the State come from the *Institut National agronomique*, and must obtain a diploma there before being admitted to Nancy. About eighty students enter the Institut agronomique annually, while the number of State students at Nancy is limited to twelve per annum, the last twelve men admitted to Nancy standing 1, 3, 6, 7, 9, 10, 15, 21, 24, 26, 39 and 48 at the final examination of the Institut agronomique. Nancy students thus at present possess a considerable knowledge of agriculture and experimental natural science; they also get pecuniary allowances from the State, so that admission to the French forest service is open to a wide field of French citizens, and is not confined, as are some of our own public departments, to a restricted class of men, who have sufficient means to pay the high cost of training involved, this restriction injuriously affecting the intellectual standard of the departments.

Forestry teaching at Nancy has responded admirably to the higher attainments of the present class of students, and it is a real pleasure for one who studied there nearly thirty years ago to note the excellence of this new text-book of sylviculture.

In it a forest is described as a complex organic whole, composed of a porous and friable humous soil, covered with dead leaves and moss, wherever the shade is too great for vegetation other than saprophytes; where, however, the mature crop of trees has been thinned or cleared with a view to natural regeneration, the soil is soon overgrown with grasses or other herbaceous plants, as well as brambles, bushes and shrubs, which, together with the young plants of the valuable forest species, form a complex mass from which saplings, poles and trees gradually emerge, and compose a new crop, either as coppice or high forest. This evolution of a new crop from an old one requires considerable skill on the part of a forester, and it is only by carefully observing and following nature that success is obtained. Each forest species makes different demands on soil and climate and requires in its young state various degrees of protection against hostile meteoric influences, injurious plants and animals.

In France natural regeneration, either by seed or by coppice shoots, is the chief means of reproducing a forest, and human interference with the growing forces of nature is reduced to a minimum. The chief classes of French indigenous high forests, reproduced by seed, consist of oak, beech or silver-fir; maritime pine in Gascony; larch and spruce in the Alps, the latter also growing in the Jura with beech and silver fir; *Pinus sylvestris* (for which our name of Scotch pine is far too local, and as a substitute for which I would suggest the name red pine) is indigenous in France only in mountainous regions, but has been extensively planted on poor sandy soils in the lowlands. There are extensive coppices of mixed underwood with oak and other standards, and of holm oak with Aleppo pine standards, in Provence. The holm oak (*Quercus Ilex*) prefers calcareous soils, and is replaced in the south of France, on siliceous soils, by the two very valuable cork oaks (*Quercus Suber* and *Q. occidentalis*), the latter differing from the former by its habitat near the Bay of Biscay, and by its taking two years to mature its

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acorns. Both these oaks are usually grown isolated in vineyards for their cork. *Quercus Tozza* is restricted to the south-west of France, where extensive coppices of it are grown for fuel. Hornbeam is abundant in the north-east, chiefly in coppice-with-standards; its abundance in Epping Forest probably dates from the time when England was connected by land with the Continent. Other species of forest trees, such as ash, alder, sweet-chestnut, sycamore, willows, poplars, birch, lime, elms, &c., are either confined to special soils over small areas, or disseminated in forests of the principal species that have been already mentioned. Maps are given in the text-book showing the geographical distribution of the principal trees.

There is an excellent chapter on the action of trees on one another, and on the value of shade-bearing species, such as beech, as auxiliaries to the more valuable light-demanding trees, such as the pedunculate and sessile oaks, the former being chiefly grown in the lowlands on deep, moist or even wet soils, as standards over coppice, and the latter with beech in high forests on the hills. Both these oaks, as well as the holm oak, are also extensively grown in coppice woods, chiefly for their bark, as tanning material.

A good account is given of the nature of forest soil, and the necessity of preserving the dead leaves to form humus is strongly insisted on. It has been proved by Grandeau and Henry, two of the Nancy professors, that besides serving as food for earthworms and other organisms, the activity of which keeps the soil porous, friable and superficially rich in nutritive mineral matter, dead leaves fix atmospheric nitrogen to the extent of 12–20 lbs. per acre annually. To deprive the forest of its dead leaves is like robbing a farm of its dung.

The evolution of a crop of trees by natural regeneration is well described, the account of coppice-with-standards being probably more complete than in any other text-book. The cultural methods to be followed when once the new crop is established are also well explained and chiefly consist of cleanings and thinnings. The authors are strongly opposed to the pruning of forest trees, and consider that drainage is very rarely required. Their remarks on these points should be read. Among sylvicultural systems yielding even-aged high forest (*futaie regulière*), the clear-cutting system (*procédé par coupe unique*), which is so extensively followed in parts of Germany for crops of spruce or red pine, is employed in France only for maritime and Aleppo pines. The cones of the pine trees adjoining a clearing produce abundance of seed, which at once stock the ground, provided the felled material is rapidly removed, and the seedlings of these trees are so vigorous and hardy against drought, that they soon dominate the mass of bushes and weeds springing up around them.

The system under which a mature crop is gradually removed (*procédé par coupe successive*), termed by Dr. Schlich shelter-wood compartment system, is that commonly employed in French high forests. It gives admirable results in oak and beech woods, but its application to silver-fir is not so successful, as silver-fir grows better when the larger trees are surrounded by an irregular undergrowth of beech and silver-fir.

The selection system (*jardinage*) similar to that employed in the Chiltern Hills for beech, is much used in France for silver-fir, chiefly in communal and private forests, and in State forests in mountainous districts, where it affords the best protection against denudation of the slopes.

About 70 pages of the book are devoted to an accoun of possible injuries to the forest by men, animals, plants and meteoric influences. This really constitutes the subject of Forest Protection, and is usually dealt with apart from sylviculture in German and English forestry text-books. One hundred and sixty pages at the end of the book treats of artificial reproduction, and resemble the account of sowing and planting usually given in other good sylvicultural works. This part of the book terminates with an account of exotic trees, the introduction of which is not viewed in France with nearly so much interest as with us, although the subject is very judiciously treated in the present volume.

The book is profusely illustrated by reproductions of photographs chiefly taken by Nancy students during their summer tour; it forms a highly valuable contribution to forestry literature, and is certainly the best account of French sylviculture that has yet appeared. There is a good table of contents, but no index, the omission of which is to be regretted. W. R. FISHER.

TOPOGRAPHIC SURVEYING.

Topographic Surveying. By Herbert M. Wilson. Pp. 884. (New York: Wiley and Sons. London: Chapman and Hall, 1900.)

MR. WILSON'S book is comprehensive, clear and well illustrated, and contains much information of practical use to the surveyor and explorer, which is not usually found in works on surveying and map-making. Its author is a member of the staff of the United States Geological Survey, and his remarks on the methods and processes of that Survey are therefore of special interest.

The Geological—which is virtually a topographical—Survey of the United States is a work of great magnitude, and the manner in which the staff engaged upon it have met the numerous technical, transport and other difficulties that have arisen during its progress is most interesting. It was laid down as a general principle that no part of the country should be surveyed in greater detail, or at greater cost, than was necessary for the purposes which the resultant map was intended to subserve. This involved a rapid and economical survey of a vast extent of country within reasonable limits of error. The method adopted

> "consists of a combination of trigonometric, traverse and hypsometric surveying to supply the controlling skeleton, supplemented by the 'sketching in' of contour lines and details by a trained topographer. In this method the contour lines are never actually run out, nor is the country actually cross-sectioned."

The instruments used vary with the nature of the country. For geodetic work, a combination transit and zenith telescope of special pattern (p. 726) has been found most convenient. Primary bases are measured with steel tapes, with an average probable error of 1/300,000, in from seven to ten days, at a cost of 20*l.* to 40*l.*; whilst the bases of the U.S. Coast and Geodetical Survey have

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